

NEW SPECIES OF MELITTOPHILOUS *PSEUDOCYPHODERUS* FROM COSTA RICA AND REMARKS ON TAXONOMY (COLLEMBOLA: CYPHODERIDAE)¹

José A. Mari Mutt²

ABSTRACT: *Pseudocyphoderus melittophilous* n. sp. is described based on specimens collected in a nest of the stingless bee *Trigona (Partamona) testacea* in Costa Rica. A discussion is included on the possible morphological adaptations of this species to life in stingless bee nests. Remarks are made on the taxonomic status of *Pseudocyphoderus* Imms and *Delamareus* Mitra. The species *Pseudocyphoderus machadoi* Delamare Deboutteville 1958 is transferred to *Delamareus*.

DESCRIPTORS: *Pseudocyphoderus melittophilous* n. sp., Costa Rica, stingless bees, *Delamareus machadoi* new combination.

Members of the family Cyphoderidae are well known myrmecophiles and termitophiles; the whole family being restricted to ant and termite nests but for several species which are commonly collected in leaf litter. Delamare Deboutteville (1948) revised the taxonomy of the family and discussed the ecology and ethology of its species.

To the present day only two springtails (both cyphoderids) have been recorded from nests of stingless bees (tribe Meloponini, family Apidae). These are *Paracyphoderus dimorphus* (Silvestri) 1911, described from nests of *Trigona (Partamona) cupira* in Mexico and *Cyphoderus* sp., near *similis* Folsom 1927 reported by Salt (1929) from Colombia.

Through the kindness of Dr. Eric Smith, Mr. Hank Dybas, and the Field Museum of Natural History, Chicago, Illinois, I have studied a collection of cyphoderids from a nest of *Trigona (Partamona) testacea* in Costa Rica. The specimens belong to a new species which is described below.

The holotype and nine paratypes are deposited in the Field Museum. Two paratypes are in the Illinois Natural History Survey and one paratype is in the author's collection.

Pseudocyphoderus melittophilous new species

Length excluding antennae and furcula up to 3.2 mm. Body coloration cream white,

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² Department of Entomology, University of Illinois, and Illinois Natural History Survey, Urbana, Illinois 61801

devoid of dark pigment. Habitus as in figures 1 & 5. Body flattened dorsoventrally, lepidiform from a dorsal aspect (Fig. 5). Mesothorax over twice as long as metathorax, notched at anterior corners, dorsolaterally surpassing posterior three abdominal segments (Abd. 1-3) small, Abd. 4 about 10 times longer than Abd. 3. Scales present throughout head, body and appendages with exception of last antennal segment (Ant. 4) and apical $\frac{1}{2}$ of Ant. 3.

Dorsal head and body chaetotaxy as in figure 5, essentially achaetotic. Antennae relatively long, segments slender, not thicker at the middle as in many cyphoderids. Attachment of antennae, labrum and opening of mouth cone ventral in position on head. Prelabral setae four, smooth. Labral chaetotaxy of formula 5,5,4, all setae smooth. Mandibles with well developed apical teeth and molar plate (Fig. 4), right mandible with 5 teeth, left mandible with 4. Maxilla with well developed teeth and fringed lamellae (Fig. 2). Chaetotaxy of labial base as in figure 8.

Coxae (Fig. 11) very large, those of each pair of legs basally very close to each other and ventral in position on the body. Trochanters large, those of metathoracic legs of adult specimens with an outer open cup like depression (Figs. 1 & 11). This depression, of unknown function, and so far unique among the Collembola, is thickly lined with scales and its borders are more sclerotized than the adjoining cuticle. Distribution of smooth (finely striated) setae on tibiotarsi as in figure 11. Aside from these setae, many ciliated setae are present upon this segment. Morphology of claws as in figure 3. Note the large basal tooth upon the base of the unguis. Tenent hair large, finely ciliated.

Chaetotaxy of anterior and posterior faces of collophore as in figures 7 & 10. Aside from these setae numerous scales are present. Corpus of tenaculum with a pair of setae arranged in a longitudinal medial line. Rami four toothed.

Manubrium twice as long as dentes. Distribution of macrochaetae on the dorsal distal portion of manubrium and dental chaetotaxy as in figure 6. Mucro absent (Figs. 6 & 12), but see under discussion of this species.

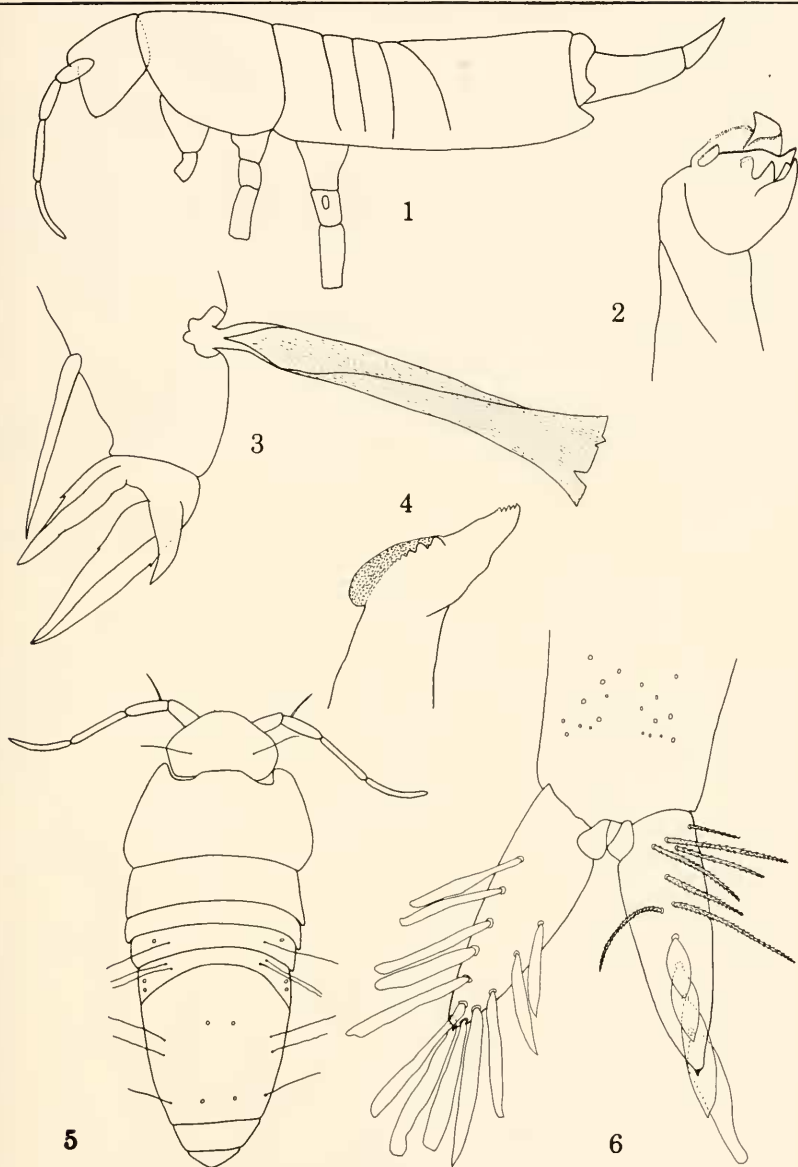
Dorsal head and body cuticle composed of quadrangular granules (Fig. 9).

Diagnosis: The new species differs from the other three members of the genus in possessing very well developed mouthparts, a cup like depression on the metathoracic trochanters of adult specimens, and in the shape of the body, particularly the mesothorax.

It differs from *Delamareus immsi* and *D. machadoi* in the structure of the unguis and in the presence of long mucrones in these species.

From *Paracyphoderus dimorphus* the new species may be separated by the presence of a well developed mucro in *dimorphus*, absence of sexual dimorphism in the new species, and in the structure of the mucro and tenent hair.

Discussion: Under the species description I state that the mucro is absent. I say this with some reservation. From a dorsal aspect (Fig. 6) the apex of the dens appears to have a short projection which could readily be taken for a short mucro. From a lateral aspect, however, the picture is more complicated (Fig. 12). The projection turns out to be the apex of the distal portion of the



Pseudocyphoderus melittophilus

Fig. 1. Habitus, lateral aspect; 2. Apex of maxilla; 3. Claw structure of metathoracic leg; 4. Apex of mandible; 5. Habitus, dorsal aspect, showing distribution of macrochaetae (circles) and lasiotrichia; 6. Chaetotaxy of apical portion of manubrium and dentes, scale striations omitted. Left dens shows only inner and outer rows of scales, right dens shows only the middle dorsal row of scales and macrochaetae.

dens, which is clearly separated from the rest of the segment by a conspicuous indentation.

It may be purported that the area distal to this indentation is the mucro. I know of no cyphoderid Collembola with scales or setae upon the mucro; is this the first? Is the indentation a secondary development of the dens and in no way related to the mucro-dens suture? I prefer the latter alternative but the true answer may very well lie elsewhere.

Material Examined: Costa Rica, Provincia Limon, Reventazon, Finca Hamburg, Jan. 21, 1938, in nest No. 33 of *Trigona (Partamona) testacea* Klug, Ferdinand Nevermann, col. Field Museum of Natural History, A. Bierig collection, acc. no. Z-13812. *Holotype* and 13 paratypes.

Morphological Adaptation and Life Habits of *Pseudocyphoderus melittophilous*—A Hypothesis

Salt (1929) and Wilson (1972) have pointed out (and exemplified) that several arthropod symbionts of stingless bees have heavily sclerotized dorsal surfaces, dorsoventrally flattened bodies, and "turtle shaped" bodies. The appendages of these species can be tightly pressed against the body or hidden under it. These morphological characteristics, it is said, are adaptive by protecting the host from the attacks and pursuits of the bees.

Pseudocyphoderus melittophilous n. sp. exhibit a series of morphological characteristics, the origin of some of which I feel could be explained by assuming their development as adaptations to life in stingless bee nests.

The dorsal cuticle of the new species is well sclerotized and composed of quadrangular granules (Fig. 9). It is also covered by a heavy coat of scales. The mesothorax is greatly enlarged, anteriorly it is notched and protects the posterior lateral portion of the head. Both meso and metathorax are expanded lateroventrally, protecting the pleuron and appendages. The coxae are placed ventrally on the body, those of each pair are very close together, in a way reminiscent of blattids. The legs are not long and can probably be hidden under the wide body. The cup like depression on the metathoracic trochanters of adults (Figs. 1 & 11) may be a further adaptation to the peculiar life habits but the adaptive significance of this feature is at present only open to speculation.

It is of interest to note here that *Paracyphoderus dimorphus*, one of the other two springtails recorded from nests of stingless bees, possesses a greatly expanded mesothorax somewhat similar to that of *Pseudocyphoderus melittophilous* n. sp. (see Silvestri 1911: 68, Fig. 1).

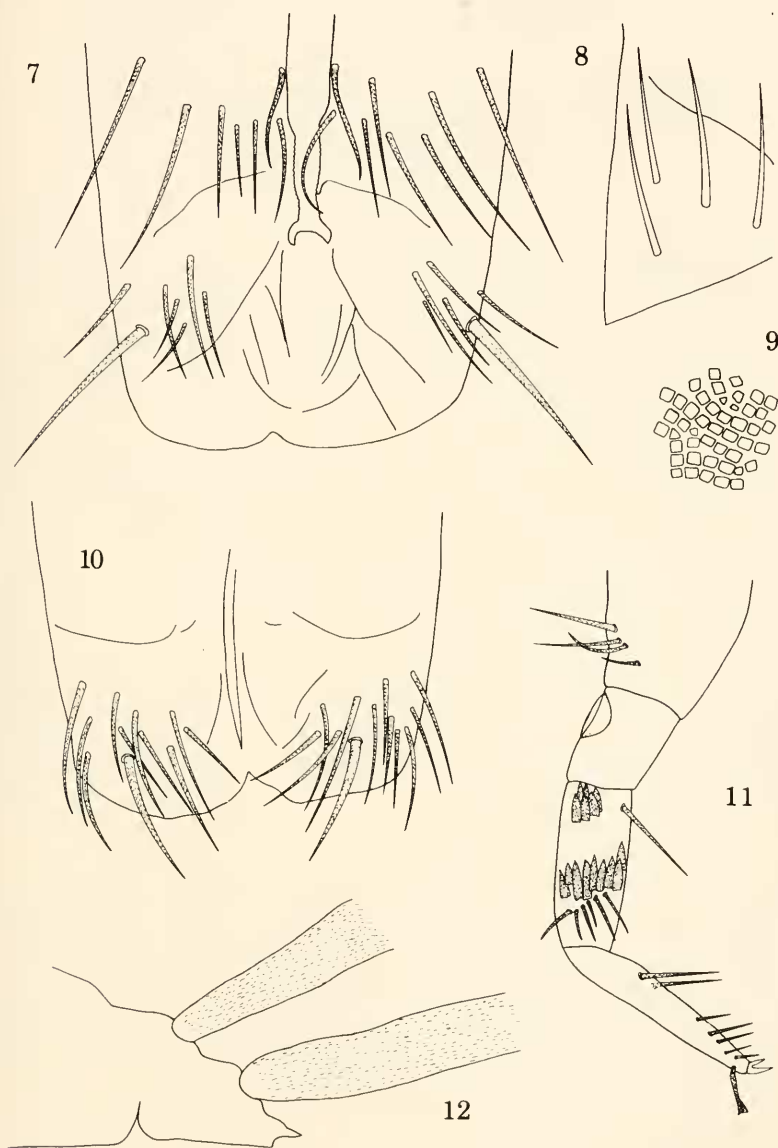


Fig. 7. Chaetotaxy of anterior face of collophore; 8. Chaetotaxy of labial base; 9. Dorsal mesothoracic epicuticle showing quadrangular granules, redrawn from a scanning electron micrograph; 10. Chaetotaxy of posterior face of collophore; 11. Metathoracic leg; 12. Lateral view of apex of dens.

**Remarks on the Taxonomic Status of *Pseudocyphoderus*
Imms and *Delamareus* Mitra**

Mitra (1977) erected the genus *Delamareus* for the Indian species *D. immsi*. The genus was to be separated from its closest relative, *Pseudocyphoderus*, by its unique ungual structure, the presence of well developed mandibles with conspicuous teeth and a large molar plate in *Delamareus*, and by the presence of a long mucro in the latter genus.

It appears, however, that Mitra overlooked Delamare Deboutteville's (1958) description of *Pseudocyphoderus machadoi* from Angola. That species, contrary to the other members of the genus, possesses well developed mandibles and a long mucro not unlike that of *Delamareus immsi*. Although the unguis of the latter species is definitely unique among the Collembola, it appears to me that the unguis of *Pseudocyphoderus machadoi* shares a few similarities with that of *D. immsi* (see Mitra 1977: Fig. 3 and Delamare Deboutteville 1958: 67, Fig. 2). Aside from the ungual structure, *Pseudocyphoderus* and *Delamareus* are seemingly equivalent.

The taxonomic status of these two genera can be resolved in one of two ways. *Delamareus* can be synonymized to *Pseudocyphoderus* or *P. machadoi* transferred to *Delamareus*. I have decided on practical grounds for the latter option and propose the following combination: *Delamareus machadoi* (Delamare Deboutteville) 1958 *new combination*. *Pseudocyphoderus* and *Delamareus* may now be differentiated on account of the structure of both unguis and mucro, and *Pseudocyphoderus* is again restricted to species with a very short mucro.

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